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ABSTRACT

This testimonial presents evidence that reduced class size (CSR) has positive effects on student learning in grades K-3. Student achievement is improved in the areas of academics, behavior and discipline, citizenship and participation in and outside school, and development into competent and productive adults. The paper emphasizes that class size and pupil-teacher ratio (PTR) are not the same, despite the fact that many people use the terms interchangeably. Research consistently shows that CSR (about 15 students per teacher) reduces achievement gaps, allows teachers to teach more effectively, and increases student test scores. The positive effects associated with CSR last longer with students who start their education early in small classes. Analysis suggests that there can be nominal to no cost increases with good planning and implementation of CSR. Reluctance to adopt CSR seems to originate from ideological differences among groups, coupled with misrepresentation and misunderstanding of facts surrounding small class size; administrator reluctance, inaction, and lack of knowledge of the class-size research base; and a tradition of fragmentation produced by lack of coherence in planning and instruction to maintain a cohesive system of education. Appendices and an attachment provide supporting evidence and recommendations for small class change. (Contains 28 references.) (RT)

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Testimony and Evidence to Support Small Classes, K-3.

C. M. Achilles

February 15, 2003

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Testimony and Evidence to Support Small Classes, K-3.
C. M. Achilles, Ed.D., February, 2003*

Based on more than 44 years in education, research, and reading in the field, I have formed some strong beliefs, backed by substantial data, about education in America. Much of this material draws upon extensive research that I have conducted, 1983-2001 on class size and student outcomes, including Project STAR (Student Teacher Achievement Ratio). Some STAR details are in Appendix A. Appendix B shows STAR-related studies 1983-2003 as part of the database that I use. Appendix C shows how STAR compares to the idea of "Scientifically based research (SBR) presented in the 2001 reauthorization of PL89-10, The No Child Left Behind (NCLB) Act.

The purposes of schooling include helping students achieve in four general areas that are similar to those expressed by James Comer, MD (The ABCD's):

- Academics, such as shown by test scores.
- Behavior and discipline, in and outside school. School climate.
- Citizenship and participation in and outside school.
- Development into competent, productive adults: Self concept.

This written material presents data to support oral comments (if they are made). For brevity, not all references are included. They are available on request. The paper emphasizes several key points:

- Class size and Pupil-Teacher Ratio (PTR) are NOT the same
- Small classes help teachers and students
- Organization and context are important in education
- Small classes and equity issues
- Some cost concerns
- How to implement small classes (13-17) in K-3 grades (Handout).

In research and science, one test of truth is consistency in findings among the scientists who conduct and analyze the studies. A second test is how well the findings hold up to peer review and scientific critique. Table 1 shows the diverse research base for small classes and that criticisms of small classes stem from a single

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* This edited and revised version of material presented to The New York State Senate Democratic Task Force on School and Equity, on 7/12/2001 has been adapted for presentation in California (3/25/03). C. M. Achilles, EdD. 4477 Snug Harbor, Geneva, NY, 14456, 315 789-2399, is Professor, Eastern Michigan University, Ypsilanti, MI and Seton Hall University, S. Orange, NJ (each 50% time). He has conducted class-size research since 1984.

source that suffers a definitional failing. A third test is what a colleague called the Grandmother Test: Do the findings and discussions of them make sense to my concerned, literate grandmother who is neither a scientist nor professionally trained in the field under discussion—that is, to a person who displays informed common sense? Consider some questions as expression of common sense about class size.

1. What is the research base for present class sizes?
2. What education improvement builds upon larger rather than smaller classes?
3. What parents ask for larger classes for their kids?
4. What exclusive private school advertises large classes?
5. Why use subcommittees, span of control, apprenticeships, tutoring?
6. What politician runs on a large-class platform?

TABLE 1 ABOUT HERE

Spinning Flax From Gold *

Reasons why class size has not been a cornerstone of education policy are many: definition, ideology, politics and constituency, historical use of a particular line of research, etc. Each reason (and others) requires its own scholarly discussion. This paper identifies some sources of confusion.

A. Definition problem and uncritical reporting (see Table 1)

B. Policy positions based on ideology rather than on research

C. "An old error is always more popular than a new truth" (Old German Proverb)

D. Political preferences and decisions not based on education research

E. An entrenched delivery of education that is driven by persons who sell "projects" and staff development

F. Tradition and processes that have not changed even though the student and requirement (e.g., inclusion) have changed.

Pages 13-14 contain four "speculations" about reluctance to use the well established class-size research. Most class-size research, especially STAR, meets the "scientifically based research" (SBR) definition in the No Child Left Behind (NCLB) Act.

* The alchemists of olden days had this correct. Is it okay to substitute the terms willy-nilly because gold/flax are about the same color?

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Table 1. Small Classes for Early Elementary Grades Have Supporters and Detractors: This Schematic Shows Some of the Forces. (Full References are Available). * [Revised 1/03]

Class Size is NOT Important			Class Size IS Important		
Idea Source	Popularizers and Advocates	Primary Outlets	Research and Other Sources	Reviews and Re-Analyses	Primary Outlets (usually refereed)
Hanushek ** (1998, 1999)	Hoxby	Legislative Reports and Testimony	Glass/Smith	Krueger	Research Reports
	C. Finn		Prime Time	Mosteller	
			STAR	Orlich	Research Journals
	Heritage Foundation	Conservative Media	STAR Follow-up	Mosteller et al.	
			Challenge	Blatchford and Goldstein	Papers and Presentation
	Conservative "Think Tanks," E.g.:	Editorials	LBS, SAGE, SSS		
			CA, TX, etc. ***	Nye, Hedges, etc.	
	Buckeye Inst.	Op-Ed Pieces	Boozer & Rouse		Federal Labs
	Goldwater Inst.	Non-Refereed Internet Postings	Burke Co.		
	Heartland Inst.		Anecdotes		OERI Pubs.
	Mackinac Inst.		Common Sense		Local news
	James Madison (FL)		Berkeley Co., SC		(sometimes)
	Evergreen (WA)	"Policy" Briefs	Litchfield, MI		
			Many Others		

* Definition is key. Some otherwise reputable sources have so confused the outcomes and claims for class size and for PTR that some publications should be considered "disinformation" on class-size policy issues. [E.g., ERIC-CEM (2002) on The Search for More Productive Schools, section on class size; NCREL (2000), Using What We Know: A review of the Research on Implementing Class-Size . . ., esp. section by Harris and Plank.

** Production-function secondary analyses are at best based on Pupil-Teacher Ratio (PTR) information from databases not originally designed to address class size. For potential benefits of PTR policy see also Wenglinsky (1997) and the continuing modest Title I evaluation outcomes. (E.g., Borman & D'Agostino, 1996; Wong & Meyer, 1998; Abt, 1997).

*** Other states have class-size initiatives, such as NV, OK, NC, NY, FL, IN: Some states such as SC, MI have pilot efforts. Some local districts are quietly moving ahead with small classes. Recent studies : Howard-Outz *(SC), Etheridge (SC), Sharp (USA and MI), Krieger (LA), SERVE (NC). No class-size study has shown negative outcomes. References available on request.

The KEY Confusion: Pupil-Teacher-Ratio (PTR) is NOT Class Size

In his guide on Educational Policy Systems, Iannaccone (1975) emphasized the issue that is at the forefront of this confusion: "descriptive reference is the first and most essential sense in which a concept has meaning" (p. 13). This author explained that: "One source of error in the scientific venture is lack of precision in the referent of the concepts. Lack of precision leads to lack of reliability in the concepts." (pp. 13-14).

An economist who often criticizes small classes using PTR arguments makes generally the same point as Professor Iannaccone. Hanushek[1] (1998) noted that 1) ". . . pupil-teacher ratios are not the same as class sizes," and 2) "The only data that are available over time reflect the pupil-teacher ratios" (p. 12). Unfortunately, Hanushek proceeds to substitute one term for the other in his works. (Emphasis Added).

Some Definitions

Class Size(s) – "The number of students for whom a teacher is primarily responsible during a school year (Lewit & Baker, 1997, p. 113)." This is an addition problem. Class size is an organization for instruction important to teachers, parents, students.

Pupil-Teacher Ratio (PTR) – "The number of students in a school or district compared to the number of teaching professionals" (McRobbie et al., 1998, p. 4). In some venues all educators are part of the computation, including counselors, administrators, etc. In this division problem, the divisor is very important. PTR is a way to assure equitable distribution of funds and is important to administrators, policy persons, etc. The difference between PTR and class size in USA elementary schools is about n=10 (Achilles & Sharp, 1998). The PTR is a formula for allocating resources; class size is an instructional organization for providing education services.

Class-Size Reduction (CSR) includes the processes to achieve class sizes smaller than the ones presently in place, such as changing the class size from 25 to 16 or so. One needs accurate pre and post data to support the change process.

Average Class Size is the sum of all students regularly in each teacher's class divided by the actual number of regular teachers in those specific classes. If the 4 2nd grade rooms have 14, 16, 18, 18 (n=65) the average grade-2 class size is 16.25.(or 16) students. PTR is an administrative formula for allocation of resources; class size is an instructional unit and organization for providing education services to clients

Data generally available in large databases are PTR data. Valid and reliable ways to get class-size data are 1) to count the students in a class and/or 2) to establish class sizes and then monitor them as in Tennessee's STAR study. Surveys provide PTR data. Databases generate PTRs.

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[1] The Evidence on Class Size (1998). Rochester, NY: W. A. Wallis Institute. Excerpts. (Emphasis Added). Berliner and Biddle (2002, February) critique Hanushek's work in "Small class size and its effects," Educational leadership. 59 (5), 12-12. (Esp. pp. 14-15.

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Evolving Class-Size Knowledge

Well controlled class-size studies are relatively new. Some examples are STAR (1984-1989); and STAR derivative and follow-up studies (approximate years):

- Lasting Benefits Study (LBS) (1989-1995)
- Project Challenge (1989-1994)
- STAR Follow-Up Studies (1997-2003)
- STAR Participation Studies (1990, 1994)
- Enduring Effects (1993-2003)
- Re-analyses (1994-2003)

Indiana's Prime Time (1981) a statewide class-size project was evaluated annually. Later experimental work (e.g., STAR) identified some reasons for inconclusive class-size results in Prime Time evaluations.

Other well designed and monitored class-size studies include:

- Project SAGE (WI), ongoing
- Burke County (NC), ongoing
- Success Starts Small (NC) Classroom Observation (1994)
- Fairfax County (VA)
- Appendix D lists important class-size studies (1970-2003)

Large-scale Class-Size Reduction (CSR) events are being evaluated (e.g., CA), but most earlier studies cited as class size studies, were studies of PTR. Those PTR studies form the base for current critiques of "class size" and, thus, should be discounted.

According to Cahen and Filby[2] (1979) "the search for an appropriate descriptive ratio has a long history in the research on class size. Any ratio is at best a crude indicator. . ." (p. 492). PTR is a contrived figure that tells little about the size of a class. The following excerpt may help clarify differences in class size and PTR. In STAR, class sizes were randomly established in the 13-17 student range. Even in STAR, when PTR is computed at the building level, the PTR for all classes—small (S), regular (R) and regular with aide (RA)—is exactly the same: The class-size distinction disappears and the PTR will hide the preponderance of large classes.

Nationally, the difference between class size and PTR is about 10: If a school has a PTR of 16:1, most teachers will face 26 or more students in class (Achilles & Sharp, 1998). Table 2 shows basic PTR and class size differences on five dimensions. These differences are most important in how education is conducted at the class level, and are not discussed in PTR computations or analyses.

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[2] Cahen, L. S, & Filby, N.. N. (1979, March). The class size/achievement issue: New evidence and a research plan. Phi Delta Kappan, 492-495, 538. [Modified from Achilles, C. M. (1999). Let's Put Kids First, Finally. Corwin .]

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Table 2. Major Differences Between Class Size (CS) or Class-size Reduction (CSR) and Pupil-Teacher Ratio (PTR).

VARIABLES	ORGANIZATION FOR INSTRUCTION	
	PTR	CS or CSR
Definition	Students (n) at a site (building, district, class) divided by: teachers, educators, adults, (etc.) serving the site.	Students (n) in a teacher's room regularly, and for whom the teacher is accountable.
Computation	DIVISION, with various divisors available depending upon the EXACT definition.	ADDITION. This cannot be accurately determined from large databases.
Concept	The teacher needs help; the student needs services the teacher cannot provide.	A competent teacher can handle most education issues if given a reasonable case load.
Operation and Context	A project and "pull-out"-driven model full of commotion and "Band Aid" treatments. Loss of time on task. Responsibility and accountability are not clear.	Teacher is responsible and accountable for the student's achievement and growth: Academics, Behavior, Citizenship, Development, (A, B, C, D) Small focused learning groups.
Outcomes	CONSISTENTLY MARGINAL. "Production function" analyses (Hanushek, 1998); Boozer & Rouse (1995); Title I evaluations, Borman & D'Agostino (1996) Wong & Meyer (1998); Abt (1997); etc.	CONSISTENTLY POSITIVE on many variables (A, B, C, D). See class-size results from many studies. Much consensual validation, anecdotal evidence, and "common-sense" support.

The literature about class size may be inconclusive, often for ideological or economic reasons or because people do not understand class-size research. The research is positive, consistent, and solid. Appendix E includes some research-consensus benefits of small classes. Between 1978 or so and 2003, researchers have determined that much of the "static" in the literature relates to confusion over the terms class size and PTR. Research and reviews of research on PTR conclude that PTR change has little, discernable effect on students' test-score gains, one common criterion for schooling outcomes. The PTR research is consistent. Not only do the works of Hanushek (a constant critic of smaller classes) show this, but, so do the meta-analyses of Title I (perhaps the largest contributor to PTR change since 1965, along with categorical efforts such as special education, bi-lingual education, or ESL).[3]

Most small-class work is focused on the early grades and this is reasonable. Researchers continue to study class size and release the latest information on re-analyses of STAR data and on long-term follow-up of STAR students. Most STAR students graduated from grade 12 in 1998 unless they were retained in grade, or moved.

The empirical research explains that used appropriately, small classes are not just adding some teachers, K-3 and doing business as usual. Small classes require early intervention, sufficient duration (3 and preferably 4 years) and intensity (all day, every day). In a transition from large to small classes, start with the lowest grades. Add one grade per year until full implementation. Starting in Kindergarten (K), or when a youngster starts school, is important as the child must learn about school.

1. Start pupils in small classes when the pupil starts school (K or Pre-K).
2. Maintain the small class (15-18 to 1) for at least 3, and preferably 4 years.
3. Avoid PTR-like events (e.g., pull outs); keep the class and teacher together.
4. Assign students randomly or at least heterogeneously in small classes.
5. Phase out expensive remedial "projects" as small-class benefits grow.
6. Carefully analyze personnel assignment and use, and adjust these as required to meet needs of new students.
7. Frequently evaluate and disseminate results.

Policy discussions should consider PTR and class size distinctions. Class size and PTR are separate concepts each with its own line of research and evaluation results. Applications of class size and PTR produce far different student and teacher outcomes. These differences should guide changes in the organization for U. S. education.

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[3] See, for example Wong and Meyer (1998), Borman & D'Agostino, Hanushek (1999),and the Abt Associates study, Prospects (1997). Work by Boozer and Rouse (1995) helps untangle this issue, too. (ERIC, ED 385 935), as does Akerhielm's (1995) work..

<u>The research-supported position on small-classes</u>: A student should experience the small class (13-17) when entering school (e.g., K or grade 1) and remain in a small class for 3-4 years. Visually this presents a funnel or "inverted pyramid." Small classes involve more than simply adding teachers and doing "business as usual." Small-class benefits and projected benefits should be factors in decisions.

<u>Small Classes Influence the Contexts of Teaching: They Help Teachers</u>

There is no question that every child should have a competent and caring teacher. Class-size research supports two other goals of the National Commission on Teaching and America's Future. For example (from Achilles, 1999, 114-116):

According to Darling Hammond (1998), part of the three-pronged central message of the National Commission on Teaching and America's Future included two elements: (Emphasis added):

- "What teachers **<u>know</u>** and **<u>can do</u>** is one of the most important influences on what students learn . . .
- School reform cannot succeed unless it focuses on creating the conditions in which **<u>teachers can teach and teach well</u>**." (p. 6)

Darling-Hammond (1998, pp. 6-11) listed conditions that influence teacher success. Of those listed, at least 13 are similar to important ones that had been isolated in the 1960s, reported as early as Lindbloom's (1970) analysis of small-class activities, and reinforced in class-size research 1978-2003.

- Work in environments that allow them to know students well
- Induction of beginning teachers (mentor)
- Communities in which students are well known
- Structures that allow teachers to know students and their families
- Teachers do not have enough sustained time with their students each day and over the years . . .
- . . . personalized teacher-student relationships . . .
- . . . greater knowledge of students' learning styles . . .
- . . . performance-based assessments . . .
- . . . accelerated and in-depth learning approaches.
- . . . stronger connections between the classroom and students' homes.
- . . . opportunity to adapt their instruction to the needs of their students.
- . . . positive changes in students' educational performance as well as their own working conditions.

> Teachers in smaller rather than larger classes personalize their instruction more, use a wider variety of methods and materials, have more student participation and fewer discipline problems.
>
> Conditions that foster good teaching also foster learning. Small classes are the cornerstone for these conditions.

This commentary reinforces the need for skilled teachers, but also supports restructuring schools so that teachers can teach. Substantial experimental evidence shows that many benefits that the National Commission seeks flow directly from small classes. The contexts in which teachers must teach influence greatly what teachers can do to teach and teach well. Evolving conditions and expectations for education make small classes even more important today (2003) than in the past when America's culture was less diverse. Consider some changing conditions under which teachers work: Inclusion of youngsters with special needs, increases in youngsters for whom English is a Second Language (ESL) or who are Limited English Proficient (LEP), increasing poverty levels of the very young, student mobility, class-size requirements for special education, etc.

Key points described by Darling-Hammond (1998), by Achilles (1999), and by other educators and researchers are addressed when class-size (not PTR) is the predominant education policy (Achilles & Finn, 2001). A second step—perhaps more difficult—will be to direct education practice from the path begun in response to Public Law 89-10, the Elementary and Secondary Education Act or ESEA (1965). That path includes special services, teacher aides, pull-out programs, and a fracturing of the class unit that is the heart of class-size importance. The ESEA and the Coleman Report (1966) helped boost reliance on PTR as a "production function" outcome that has become a proxy for class size.

Organizational and Context are Important in Education

A common education and policy response to education improvement is "staff development." Educators could be expected to embrace this because it is a form of education, but staff development may be overemphasized. Staff development has little to do with the conditions of teaching (Darling-Hammond, 1998, p.6), or with present alternatives to public education, such as private school, home school, charter school, or vouchers. These options are about organization issues, not about staff development.

Dennis Sparks, Executive Director of the National Staff Development Council (NSDC), noted that there is a need for a "paradigm shift" in staff development. Sparks continued, "While the knowledge, skills and attitudes of individuals must continually be addressed, quality improvement expert W. Edwards Deming estimates that 85% of barriers to improvement reside in the organization's structure and processes, not in the performance of individuals" (p. 3). The 15% is important, of course, because of the labor-intensive nature of Education. Yet, the 85% seems to be the place for intense work. Deming (1993) later changed this to 96% - 4%.

To a school administrator, 85% should seem like a better bet for action than 15%. What, then might educators consider as a first step in getting school reform on track to improve schools and make them better places for kids?

If 85% of the barriers to improvement reside in the organization, and only 15% in the performance of individuals, educators and policy persons would do well to attend to the organization, and especially to those organization elements that significant research has shown to have positive effects on student outcomes, that are administratively mutable, and that improve schooling. Here are some examples.

- Class Size
- School Size
- Use of Time
- Grade Levels
- Grade Retention
- Individualized Instruction
- Classroom Organization
- Etc.

Small Classes and Equity Issues

Equity provided by small classes—achievement-gap reduction, reduced grade retention, decreased disciplinary action, increased minority college-entrance test taking—must be balanced against claims that smaller classes raise education costs.

Some equity concerns are test scores, grade retention, disciplinary action, use of teacher aides, and plans for college. The STAR longitudinal (1984-1990), large-scale (about 11,600 students, 1300 teachers in 79 schools in 42 districts) randomized experiment provides one base for these comments about education equity issues.

About 44% of the 11,600 STAR students were minority (primarily African-American) and 56% were on free and reduced lunch. Finn (1998) noted ". . . the small-class advantage was consistently greater for minority students . . . than it was for whites. In most comparisons, the impact on minorities was about twice as large as it was for white students. This resulted in a considerably reduced achievement gap." (p. 10).

Small-class study outcomes vary, but most echo Wenglinsky's (1997) national finding: "In other words, fourth graders in smaller-than-average classes are about a half year ahead of fourth graders in larger-than-average classes." and "The largest effects seem to be for poor students in high-cost areas" (pp. 24-25). In 1990, Robinson had concluded about the same: "Smaller classes can positively affect the academic achievement of economically disadvantaged and ethnic minority students" (p. 82).

Finn and Achilles (1990) reported that "The difference between minorities and whites in mastery rates on the grade-1 reading test was reduced from 14.3 percent in regular classes to 4.1 percent in small classes (p. 568). STAR results on the percentage of first graders who passed criterion-referenced tests or CRTs (88% white and 87% nonwhite) that assess mastery of what is taught show that when children start in K in small classes (13-17 students), an achievement gap opens less far in grade 1 than if students start in a regular-sized class (22-25 students). (Achilles, Finn & Bain 1997/98).

Table 3 shows small-class test-score benefits for minority and poor students.

Table 3. Percentage of Groups of Students Passing Grade-1 CRTs by Class Size , STAR

STUDENT GROUP	SMALL CLASS 13-17	REGULAR CLASS 22-25	Diff.
No Free Lunch	91	88	-3
Free Lunch	84	77	-7
Diff.	-7	-11	-4
White	88	86	-2
Minority	87	77	-10
Diff.	-1	-9	-8

STAR analyses show that teacher aides (a common intervention for services to minority students) are not an effective substitute for small classes. (Gerber et al, 2001; Finn et al., 2000) The RAND (2000)study, Increasing Student Achievement (Grissmer et al.) found that "we also estimate that the use of in-classroom teacher aides is far less cost effective than the policies cited above" (i.e.., smaller classes and public pre-kindergarten). (p. xxvii).

Retention in grade, a practice that falls heaviest on minority, poor, and male students is substantially reduced in small classes. In STAR the percentage of retention in grade (4-year average) was 4.9 in small and 6.8 in large classes (Word et al., 1990, p. 170). In STAR small classes the average score for retaining a student in Kindergarten was 422, but it was 427 in a larger class. On average, students scoring 423-426 were retained in large classes but promoted in small classes, probably because teachers knew the student better and recognized the potential of a small class to help the student (Achilles, Finn & Bain, 1997/1998).

Disciplinary action falls disproportionately on minority and male students. In small classes disciplinary office referrals are reduced as much as 50%.

Krueger and Whitmore (2000) found that attending a small class in early grades (K-3) reduced the college-entrance exam test-taking rate between white and black students from "13.3 percentage points for students in regular-size classes, and 6.4 percentage points for students in small classes." "Attending a small class reduced the black-white gap in the college-entrance-test-taking rate by 54 percent" (p. 2).

The Basic Cost Questions.

Are smaller classes expensive? Do they require large numbers of new teachers (a major source of cost increases)? The answer is, "It depends."

Discussions above of the equity issue relate to costs. Most predictions of dire cost increases associated with small classes fail to consider a) costs minus benefits, b) long-term outcomes, and c) what the class-size research says.

Vignettes of Small Classes (Cost Stories from Actual Sites).

Despite dire predictions of huge small-class costs that are based upon PTR models or upon PTR masquerading as class size, observations and analyses of actual small-class initiatives show that the goals can be achieved at little or no added costs if the implementation builds upon the research. Here are actual scenarios.

1. A small district in Michigan (n=600 pupils) achieved class sizes in K-4 of 15 or fewer pupils within the regular budget by re-assignment of personnel, some job consolidations, reduction of teacher assistants via attrition, and elimination of "projects" based on small-class benefits. Student achievement, teacher morale and district support are all demonstrably higher than before the CSR in this Michigan district. (e-mail personal communication)

2. A mid-size district (n=14,000 pupils) achieved class sizes of about 14 students, K-4, by careful planning, reductions in remediation projects as small-class outcomes allowed, by extending productive inclusion efforts, and by reallocating funds through attrition of teacher aides. After initial cost outlays for facility renovation, the small classes are within the normal state per-pupil expenditure range. Achievement in this previously low-achieving district is among the highest in North Carolina. The K-4 small-class benefits carry over into upper grades. (Egelson et al., 2002; Achilles, Harmon & Egelson, 1995).

3. As part of a major national study of class size and PTR from 1997-2002, Sharp (2002) conducted a case analysis of a single district's finances and resources to determine if the district could achieve small classes (n=14-16 pupils) in grades K-3. His results affirmed that with careful planning, assessment of current program outcomes, and using only reallocation of current resources the district could achieve small classes in K-3. The suggested reallocations were based on the expected outcomes of small classes as determined by the extensive class-size research.

If small classes are implemented in accordance with the research, starting in K or K-1 and adding one grade per year until grades K-3 or K-4 are small, costs can be minimal. This is achieved by reallocating personnel, assessing small-class benefits against costs, and recognizing the incentive value of small classes.

If a school site has sufficient personnel to have a PTR of 14:1, then it seems reasonable that if personnel were reallocated in accordance with class-size research, there would already be enough teachers available for small classes (14-16) in grades K-3. Darling-Hammond (1998, p. 11) demonstrated this situation in a figure showing that in 1995 only 43% of U.S. teachers were regularly facing a class all day, every day. (The

balance were "specialists" such as Title I, or staff development, or in other roles. They did not have a "regular" class.). Organization changes and reallocation of existing resources to change education outcomes are at the heart of small-class research. Making these changes will require leadership, communication, and change skills, for as the old German proverb goes, "An old error is always more popular than a new truth."

Speculations About Reluctance to "Do" Small Classes

Educators' reluctance to operationalize what about 100 years of research has shown does hint at educator complacency and misdirected policy. This section includes only an outline of ideas generated while this paper was in process and from CSR work.

The barrier to implementing small classes in early grades is not parents or the citizenry in general. What politician runs on a platform of larger classes? People know the value of small classes. Elections in 2002 affirmed citizen support for the proven value of small classes. Voters elected class-size reform governors in many states: Arizona, Illinois, Iowa, Kansas, Michigan, Pennsylvania, and Wisconsin, a state with an effective class-size initiative. Voters passed a class-size constitutional amendment in Florida and overwhelmingly elected a class-size advocate as superintendent of public instruction in California. Small-class benefits thrive selectively. (Gifted, special needs). They should be available to all students, because they provide a base for excellent education, and all students are special. If the roadblock is not parents and citizens, then what is it? I propose three groups of people and one tradition. The tradition began in 1965 and has not carefully been assessed in light of social changes and education demands. Here is an outline of key issues.

1. Ideological differences. Some groups strongly advocate their own ideas about education and constantly offer plans for education that have little or no support in education or social-science research. To advance their agendas, the groups attack small classes on a variety of fronts, often with no data or with hypothetical data: No space, no personnel, no money, no solid research, etc. A popular strategy is to parade pupil-teacher ratio (PTR) data that, truthfully, show little production gain and to claim that PTR equals class size. A second source of ideological differences relates to the value (both cost, and claims of effectiveness) of one improvement agenda over another. An example of this issue is the dissonance between "Teacher quality" (whatever that is), and class size (clearly defined and measurable).

2. Administrator reluctance/inaction/lack of knowledge of the class-size research base. The reluctance may be fed by the constant call among politicians and policy people for a "quick fix." Small classes are primarily preventive, and not remedial. Thus, solid results of a small-class initiative will take 3-4 years to show up in the testing outcomes. Administrators need to be seen as "doing something—anything," and small classes just seem too simple. Besides, if administrators keep plugging professional development for teachers, they can shift any blame for perceived school failure from themselves to teachers.

3. Teachers may vocalize support for small classes, but often when they realize that small classes may require other changes, they waffle (usually only briefly, until they begin to feel the professional reward of responsibility, success, and accountability). One superintendent of schools negotiated small classes, K-4, into the teacher

contract. Teachers would have no more that 15 students per class (most had 13-14 students). In return, all funds were directed to teaching positions, reducing "support" personnel; teacher assistants were reduced via attrition and those funds went into teacher salaries. At first, teachers complained that they had no place to send reluctant learners and discipline cases. (They were used to aides, specialists, transitional classes, etc.). The superintendent explained that they, the teachers, were the specialists and the "treatment" for the students was to be with them, the teachers, all day, each day as students learned what needed to be learned.

4. Tradition. Since about 1965, teachers have become accustomed to fragmentation in their lives, and to the disruption and lack of coherence in planning and instruction that accompanies sending difficult-to-teach kids to "specialists" (who are not accountable for the student's basic test scores). One critique of an earlier "excellence movement" in education explained Title I and "project mentality" as follows (Wayson et al., 1988).

> . . . reforms intensified the rigidities of the education system; they depersonalized the education process; they weakened the profession by creating splits between educators; they glorified specialization by elevating teachers to positions of dominance over other teachers; they narrowed roles for teachers; and they diminished power and respect for those who work most closely with children (p. 115).

Because many teachers today started teaching since Title I (1965) they are inured to this bleak scenario. The use of small classes in K-3 will get the system back on track—but the teachers must step up to be counted, for class-size success will require them to assume a professional case-load responsibility of a workable number of students. (This does NOT mean the elimination of all specialists and projects. It does mean a reassessment of business as usual, using what we know now and accommodating diversity, ESL, inclusion . . .).

The difference between class size and PTR in U. S. schools (about n=10) provides one place to start planning how to achieve small classes. Small-class benefits such as reduced grade retention, and need for remediations, and successful inclusion outcomes provide short-term cost relief. Because they impact students and teachers (and parents, too, in some cases), appropriate-sized classes are an incentive to attract and keep teachers, a factor in any teacher shortage.

Table 4 summarizes many reasons that small classes grades K-3 or so, work to improve education outcomes and should be Education's new truth: "Class size should become the cornerstone of American education reform."

TABLE 4. Small Class (K-3) Benefits Are Supported by Research and Established Theories About Groups, Teaching, Learning, and School Outcomes.

I. LEARNING

A. Task Induction: Learn About School (Student's Work).
B. Participation, Engagement, Identification.
C. Mastery of Basics
D. Time On Task Increases.
E. Appropriate Homework
F. Child Development/ Developmentally Appropriate.
G. Early Intervention, Duration

II. TEACHING

A. Individual Accommodation.
B. Early Diagnosis And Remediation Of Learning Difficulties.
C. Teach To Mastery.
D. Immediate Reinforcement.
E. Assessment (In-Class)
F. Portfolios, Running Records.
G. Effective Teaching Methods.
H. Planned, Coherent Lessons. (Seamless Transitions).

III. CLASSROOM

A. Classroom Environment (E.g.: Air Quality, Materials, Space, Crowding, Noise).
B. Personal Attention/ Community.
C. Inclusion, Special Needs
D. Variable Room Arrangements (E.g., Learning Centers).
E. Classroom Management.
F. Less Indiscipline
G. Many Volunteers.

IV. "OTHER"

A. Increased Parent Interest.
B. Reduced Grade Retention
C. Increased Teacher/Student Morale/Energy.
D. Teacher Accountability and Responsibility
E. Few Projects and "Pull Outs." (Coherence). Intensity
F. Student-Led Activities
G. Assessment (Outcome)
H. Field Trips Possible with Fewer Adults/Smaller Vehicles

V. STUDENT BEHAVIOR (B)[*].

1. Class size and Engagement: More Engaged in Learning and Pro-social (B) and Less in Disruptive (B). Principles: 1) "Visibility of the Individual" a) Time per Student, b) Diffusion of Responsibility and c) Social Loafing; 2. Sense of Belonging a) Group Norms [e.g., Learning (B)] Influences All Members, b) Psychological Sense of Community (PSOC) such as Support and Inclusion. Results are Similar to School Size Work.

[*] (Finn et al., 2002. The "Whys . . .". pp. 41-43. In Process)

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Appendix A

A Longitudinal Class-Size Experiment: Scientifically Based Research.

STAR (1985-1989) and the many studies that build upon STAR benefit from the experiment's tightly controlled, in-school, randomized longitudinal design. STAR was conducted by a four-university consortium with considerable external support from consultants, advisory groups, and the Tennessee State Department of Education. Basic design issues are:

(1) STAR was a controlled four-year longitudinal experiment that permitted, to the extent possible with empirical data, causal conclusions about outcomes. Pupils entering K were randomly assigned to a small class (S; 13-17), a regular class (R; 22-27), or a regular class with a full-time teacher aide (RA). Pupils entering in later years were assigned at random to classes. Teachers were assigned at random. Randomization and testing were monitored carefully.

(2) Built on prior research STAR began in primary grades. Small classes had fewer than 20 students. STAR's post-test only design. (Campbell & Stanley, 1963) enabled researchers to study the effects on minority, majority, male and female students. The design produced a "real" difference in the class sizes, from an average of 24 pupils to an average of 15.

(3) The samples were large and diverse. The K year involved over 6300 students in 329 classrooms in 79 schools in 46 districts. The first-grade sample was larger still. The large samples were maintained throughout the four years, producing an excellent longitudinal database. Total sample = 11,601.

(4) With minor exceptions, students were kept in their class in grades K-3 (cohorts). A new grade-appropriate teacher was assigned to the class each year.

(5) The class arrangement was maintained throughout the day, all year long. There was no intervention other than class size and teacher aides. Teachers received no special training except for a small sample in second grade; no special curricula or materials were introduced. (Training didn't increase outcomes).

(6) Norm-referenced tests (NRT), and criterion-referenced tests (CRT) and measures of self concept and motivation were administered each spring. Students were aggregated to classes and classes nested into schools for analyses. Teachers and teaching were studied, as were grade retention, participation, aide use, etc.

(7) Students were followed and evaluated after STAR ended in grade 3. Most students graduated in 1998. Their college-entrance test results were monitored. (Krueger & Whitmore, 2000). Dropout rates were analyzed Pate-Bain, Boyd-Zaharias, Finn (In Process).

APPENDIX B. Samples of the STAR Legacy of Class-size Studies, Categorized as "Subsidiary" (directly from STAR), "Ancillary" (using the STAR database) and "Related" (usually involving STAR researchers and expanding STAR earlier findings).

CATEGORY, TITLE & PURPOSE *	DATE(S)	AUTHOR(S), SOURCE, DATE
STAR Pilot (DuPont)	1984-1986	Bain et al. 1984, 1985
STAR (Class-size Experiment)	1985-1989	Word et al., 1990. Others. Finn & Achilles, 1990
Subsidiary Studies		
• Lasting Benefits Study (LBS)	1989-1996	Nye et al., 1991-1999
• Project Challenge (TN)	1989-1996	Nye et al., 1991-1995
• Participation, Grades 4, 8	1990, 1996	Finn, 1989, 1993; Voelkl, 1995; Finn et al., 1989; Finn & Cox, 1992
• STAR Follow-up Studies	1996-2000	HEROS, 1997-2003
Ancillary Studies		
• Retention in Grade	1990-1995	Word et al, 1990; Harvey, 1994, 1995
• Achievement Gap	1993-2001	Bingham, 1993, 1994; Achilles et al., 1997-98, 2000, 2001, 2002
• Value of K in Classes of Varying Sizes (test scores)	1985-1989	Achilles, Bain, Nye, 1994
• School Size and Class-Size Issues	1985-1989	Nye, K., 1995
• Random v. Non-Random Pupil Assignment and Achievement	1985-1989	Zaharias et al., 1995
• Re-analysis, Sample "drift" (out-of-range classes)	1985-2001	Boyd-Zaharias et al., 1995 Finn et al., 1999, 2001
• Class Size and Discipline Grades 3,5,7	1989, 1991, 1994, 1996	Several studies. SSS, 1995; Hibbs (1997).
• Outstanding Teacher Analysis	1985-2001	Bain, 1992; Boyd-Zaharias, 2001
• Teacher Aides	1990-2002	Achilles et al., 1994; Finn et al., 2001; Boyd-Zaharias & Pate-Bain, 1998 Gerber et al., 2001
• Continuing student growth	1985-2003	Finn, Achilles et al.; Bain et al.
• College entrance exams	1999-2001	Krueger & Whitmore (2000, 2001)
• Enduring Effects	1999-2003	Finn et al., 1999,2000, 2001, etc.
Related Studies		
• Success Starts Small (SSS): A Study in 1:14 and 1:23 Schools	1993-1995	Achilles et al., 1994 Kiser-Kling, 1995
• Burke Co., NC Study	1992-2003	Achilles et al., 1995; SERVE
• SERVE Studies in NC	1994-2003	SERVE, 1996, 2002; Harman et al., 1998
• Education Production Functions	1996-2003	Krueger, 1997-2002

* This is a sample of STAR-related class-size studies. Not all authors appear exactly as listed here. A similar table appears other STAR reports and articles. Several have reported on STAR (e.g., Mosteller, 1995; Finn, 1998; McRobbie et al., 1998); several non-STAR persons have conducted secondary re-analyses of STAR data (e.g., Goldstein & Blatchford, 1998; Krueger, 1997-2001, Nye et al., 1999-2002).
Many single-district studies, dissertations and re-analyses.

APPENDIX C
COMPARISON OF STAR DESIGN, PROCESSES, AND FACTS WITH ONE SET OF "PRINCIPLES OF INQUIRY".*

"ALTHOUGH NO UNIVERSALLY ACCEPTED DESCRIPTION OF THE PRINCIPLES OF INQUIRY EXISTS, WE ARGUE NONETHELESS THAT ALL SCIENTIFIC ENDEAVORS: ...

SCIENTIFIC ENDEAVORS*	**STAR DESIGN, PROCESSES and FACTS**
1. **Pose Significant Questions That Can Be Investigated Empirically.** The initiating law required questions and processes. Researchers added others	1. STAR was driven by two significant, major questions: What is the EFFECT of small classes in primary grades on the 1) Achievement and 2) Development of students? Researchers addressed secondary questions required or implied in the legislation: Effects of a) full-time teacher aide, b) training, c) duration, d) cohort, e) random assignment. (See Table 5). Researchers studied other questions: teacher quality (by credentials), comparisons of sample with state averages, checks on "randomness," time use, teaching processes, incentive value . . .
2. **Link Research to Relevant Theory.** (STAR began in 1984, so some design and theory issues we now know (2003) were not yet refined. Table 8 is a summary of some theories supporting STAR.	2. STAR was deeply rooted in prior research and theory. Theories are evident in the design, data forms, analysis steps. Additional theory and refinements were "teased out" during the study (1984-1990), as data were analyzed (some data still await analysis), as STAR played into Project Challenge, and while students progressed throughout their schooling for longitudinal results (they would graduate from High School in 1998, if on schedule).
3. **Use Methods That Permit Direct Investigation of the Questions.** The variable of focus was class size so only class size was manipulated; the Aide was a Pupil- Teacher Ratio (PTR) element. STAR represented school as it is normally operated.	3. "Effect" required an EXPERIMENT (Campbell & Stanley, Design #6), of sufficient Duration (4-years), Magnitude (at least 80 classes of each type – eventually 11,600 students). The experimental plan was small class (S) at 13-17; regular (R) at 22-25; and full-time Aide (RA) at 22-25. Within-school design was parsimonious, reduced school-level effects, eliminated control group mortality, moderated the "Hawthorne Effect" if it might be a factor (Appendix A summarizes the experiment).

* Feuer, M.S., Towne, L. & Shavelson, R. J. (2002, November). Scientific culture and educational research. Educational Researcher, 31 (8), 4-14. p. 7.

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APPENDIX C. COMPARISON OF STAR DESIGN, PROCESSES, AND FACTS WITH ONE SET OF "PRINCIPLES OF INQUIRY"** (con't)

"ALTHOUGH NO UNIVERSALLY ACCEPTED DESCRIPTION OF THE PRINCIPLES OF INQUIRY EXISTS, WE ARGUE NONETHELESS THAT ALL SCIENTIFIC ENDEAVORS: ...

4. **Provide a Coherent and Explicit Chain of Reasoning.** Longitudinal class-size studies were needed to test duration. Without an experiment, effects of SES, teacher, principal leadership (etc.) clouded the class-size issue/effects.	4. Much of the reasoning appears in the STAR Report literature review, data instruments, observation data, research questions, sample, and design. Prior to STAR there was disagreement on the effects of group (class) size on student outcomes. Before establishing statewide class-size limits, Tennessee lawmakers and policy persons sought evidence about class size and paraprofessionals. They commissioned STAR
5. **Yield Findings That Replicate and Generalize Across Studies, and:** Work continues here as more states, and local districts move into class-size changes. Note International work in Australia, England, Netherlands, Sweden. (see also Tables 3 and 4)	5. STAR results have been replicated and generalized in state studies (e.g. SAGE in WI); by state law (e.g. HB 72 in TX); in observations (SSS); in cases studies (e.g. Rockingham Co, NC); in large (n=15,000) and small (n=1200) districts (Burke, Co. NC; Litchfield, MI); in Title I schools (n=16) in a large district; in single schools (SC, NC, LA). "Micro" comparisons contrast with "macro" or statewide events (e.g., NC, TN, TX, IA, UT) and even in NV that did some PTR and in CA, a "near text-book case of doing it wrong" (Biddle & Berliner, 2002). Results are always positive.
6. **Disclose Research Data and Methods To Enable and Encourage Professional Scrutiny and Critique**.*** STAR data, methods and outcomes are in the Final Report, papers and articles by the PIs, dissertations, and other print sources.	6. The Spencer Foundation assisted PI's to organize, clean, and post STAR data on "The Web." After the final report was accepted, data were provided to researchers in London and later to persons in the USA. Critique is evident in some journal articles. "Scrutiny" is in the hands of the secondary analyzers, and has seldom been rigorous, absent pre-conceived ideology.

** Feuer, M.S., Towne, L. & Shavelson, R. J. (2002, November). Scientific culture and educational research. Educational Researcher, 31 (8), 4-14. P. 7.

*** The narrowness of most STAR critiques suggests that the STAR Report and Papers (The Primary Sources) were read by few (e.g., Mosteller, 1995; Burke, Co. administrators; SAGE staffers; SERVE personnel, Doctoral Students); Few persons engaged the four Principal Investigators (PI's) in discussions or asked important questions so they could understand STAR outcomes. Professor Mosteller (1995) actually explained that in reality STAR was THREE studies. (STAR, LBS, CHALLENGE)

APPENDIX D

Some Class-Size Studies and Research Summaries, 1970-1999: Thirty years of The Present Generation of Class-Size Work as Validation of Class-Size Effects and for Reliable Outcomes.

Author, Study	Source/Date *
Lindbloom	1970
Olson	1971 (From Cavenaugh, 1994)
Glass & Smith	1978
Smith & Glass	1979
Filby et al.	1980
Glass et al.	1982
Shapson et al.	1980
Evertson & Folger, Evertson & Randolph	1989
STAR (Generally)	Word et al. (1990)
Teacher Interviews	Johnston (1990)
Good Teacher Study	Bain et al. (1992)
Robinson	1990 Research Review
Project Success (NC)	1994 (In Achilles et al., 1994)
Success Starts Small	Kiser-Kling (1995)
Wenglinsky	1997 (ETS)
Participation & Achievement	Finn (1998, 1993, 2003)
SAGE (Wisconsin)	Molnar et al.(1998, 1999)
California CSR	CSR Consortium (1999-2003)
In Process (STAR-Related	1999 → and ongoing
Long-Term Effects (STAR)	Krueger, Bain et al. (2000-2003) Finn, Achilles et al. (1999-2003)
Teacher Aides	Finn, Gerber et al. (2000-2002) Bain, Boyd-Zaharias, Achilles (1993-2002)
Enduring Benefits	Finn et al., Krueger & Whitmore (2000)

* Many of these studies have been review briefly in Achilles (1999) Let's Put Kids First. The work of B. Bloom on tutoring and the "2-Sigma Problem" (1984) is foundational.

APPENDIX E. Synopsis of Class-Size Findings from STAR and Various Other Sources.*

Findings, Idea, Issue		Selected Sources of Support
I.	Class-size effect was found in all sites, for all participants, at all times and grades K-3, This includes tutoring and "special" projects.	STAR, Challenge, Reading Recovery (RR); Success for All (SFA)
II.	Small classes work best when students start (K, 1) school in them; they are preventive, not remedial. Formal and small-class education MUST start no later than K, be intense (all day, every day) and last at least 3 years (Duration).	STAR, SSS, Challenge SAGE, Burke Co., Abecedarian (NC), Finn & Achilles (1999) Perry Pre-School, Finn et al., 2001
III.	Crowding, not just small classes, is an issue. School safety and environment are improved. (Prout, 2000). School size is important.	STAR, SSS, K. Nye, Fowler & Walberg, Behavioral Research, Cotton, others.
IV.	Although all pupils benefit from small (S) classes in K-3, some students benefit more than others.	STAR, SFA, RR, LBS, Other class-size work. Robinson (1990).
V.	The teacher is important. Each pupil's learning depends upon the teacher and others in the class. (Thus the class is the unit of analysis).	STAR, LBS, SSS, Challenge, Burke County, CSR in California.
VI.	A teacher aide does not improve student outcomes. This adds to crowdedness and causes new dynamics (Issues: Training, inclusion, ESL, role description).	STAR, Other Studies. Finn, Gerber et al., (2001); Bain & Boyd-Zaharias (1998); Gerber et al. (2001).
VII.	Teachers should use known educational-improvement processes: (Parent and home involvement, portfolios, alternative assessments, etc.). Small classes may not change what teachers do—just how much they do good things well.	STAR, LBS, SSS, Filby et al., Burke County, NC; Downtown School, NC STAR Teacher Studies. Achilles, 1999, 2002, 2003
VIII.	Reduce retention in grade especially when student will be moving into another small class. (Retention should not be used, unless in extreme cases).	STAR, Many studies of Retention (Holmes and Matthews).
IX.	Study costs and benefits; Use PTR and class size differences to get to small classes.	STAR, SSS, PTR studies, Sharp, Darling-Hammond; Miles
X.	Small classes and small schools encourage increased student participation in schooling. (Engagement)	Finn, Voelkl, STAR, LBS, Lindsay's work, etc., Finn et al., (2001; 2002)
XI.	Small classes in early grades provide long-term multiple benefits (achievement and development).	Krueger; STAR Follow-up. Finn & Achilles, (1999), Finn et al., (2001), Krueger & Whitmore (2002).

* Detailed references are available. They were omitted because of space. RR = Reading Recovery; SFA = Success for All; SSS = Success Starts Small.

ATTACHMENT A *

RECOMMENDATIONS FOR CLASS-SIZE CHANGE

As the move to implement appropriate-sized classes in America's public schools escalates, educators have much information available. From years of studying and observing small classes, researchers and scholar practitioners have compiled a research base, theories, and exemplary practices of outstanding teachers to guide effective implementations of small classes. Informed Professional Judgement or IPJ is at the heart of class-size changes. **SMALL CLASSES ARE NOT SIMPLY HIRING TEACHERS AND DOING BUSINESS AS USUAL.** A class-size initiative will incorporate what the long-term class-size research has determined are important steps for successful schooling outcomes.

1. EARLY INTERVENTION. Start when the pupil enters "schooling" in K or even pre-K.
2. SUFFICIENT DURATION. Maintain the small-class environment for at least 3, preferably 4, years for enduring effects. Encourage parent involvement in schooling.
3. INTENSE TREATMENT. The pupil spends all day, every day in the small class. Avoid Pupil-Teacher Ratio (PTR) events, such as "pull-out" projects or team teaching. Develop a sense of "community," close student-teacher relations, and coherence.
4. USE RANDOM ASSIGNMENT in early grades to facilitate peer tutoring, problem-solving groups, student-to-student cooperation, and active participation and engagement. (STAR).
5. EMPLOY A COHORT MODEL for several years so students develop a sense of family or community. STAR results show the power of both random assignment and a cohort model. "Looping" adds teacher continuity to the cohort, and may be a useful strategy for added benefits. (Research is needed here).
6. EVALUATE process and outcomes carefully, and share results. Appropriate-sized classes in elementary grades will take policy and perhaps even legislation change.

The difference between the PTR and actual class size provides some guidelines for planning. If the site has a PTR of 12:1, that suggests enough personnel to work toward class sizes of 15:1 or so and still keep some teachers for special assignments.

Adding ever endless "projects" ala Title I and continually disrupting the teacher's and students' day and continuity (e.g., coherence and stability) are not what the class-size research is about. To avoid needless costs and confusion, start in K and 1, add a grade per year through third grade. Reduce "specials" as small-class benefits will allow and re-allocate personnel to teach small classes.

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* This compilation of class-size information from many studies and from practice appears in similar form in several papers by C. M. Achilles and J. D. Finn.

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